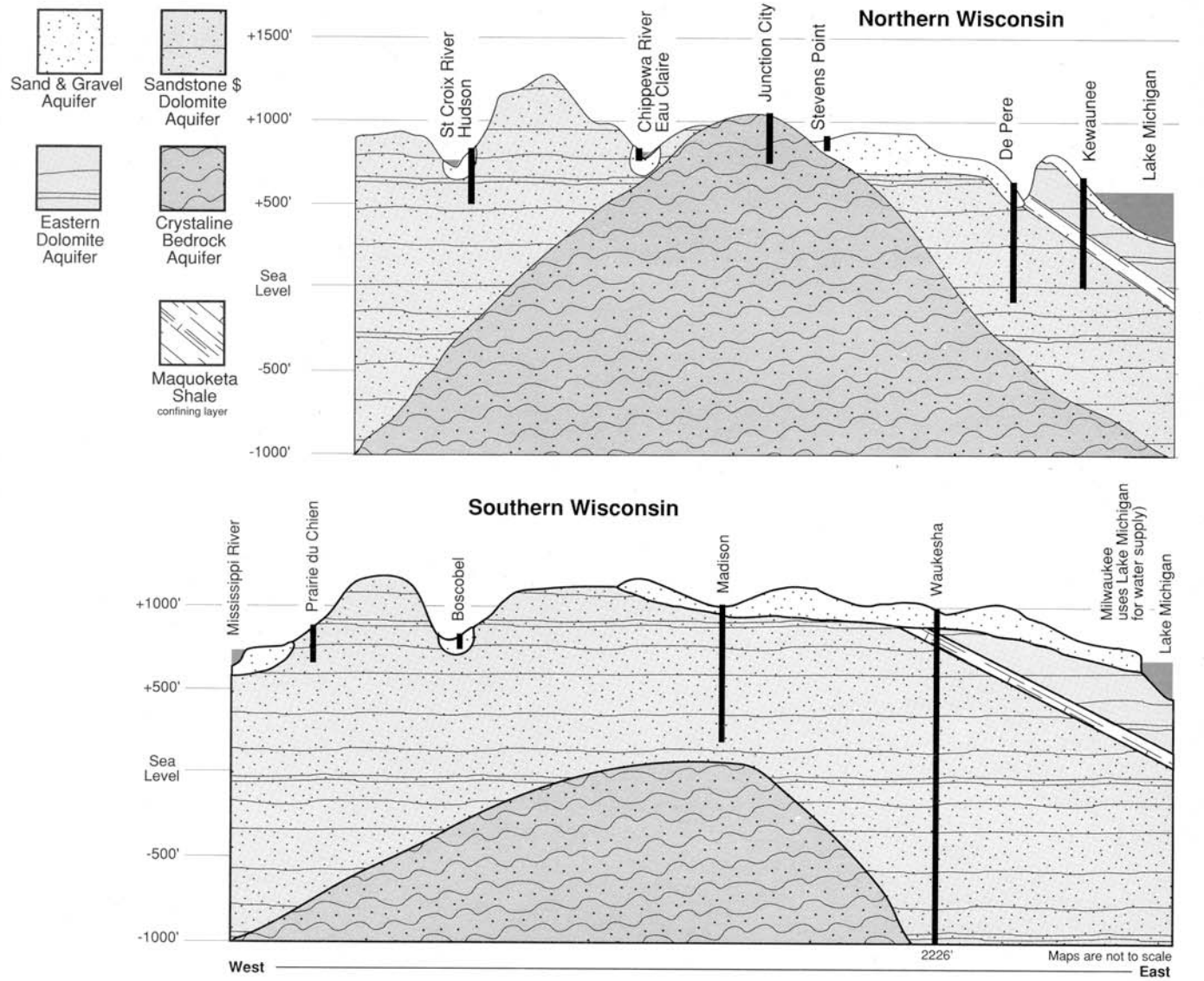
Wisconsin's Major Aquifers



Goals: To help students become familiar with Wisconsin's four major aquifers.

Subjects: Science, Environmental Science

DPI Objectives: SC: A2, A3, B3

Grades: 6-9

Materials:

- ❖ Wisconsin's Major Aquifers—overhead*
- ❖ Wisconsin's Aquifers—activity sheet*
- ❖ Wisconsin's Major Aquifers—teachers key
- ❖ colored pencils

* Two cross-sections of the state are provided. You may choose a northern or southern cross-section for this activity.

Background: An *aquifer* is an underground formation that can store and transmit water. Most of Wisconsin is underlain by thick, permeable deposits. These layers of rock and soil make up our state's four major aquifers: 1) the sand and gravel aquifer, 2) the eastern dolomite aquifer, 3) the sandstone and dolomite aquifer and 4) the crystalline bedrock aquifer. A few areas in northern Wisconsin are made up of clay soils overlying granite or other non-porous materials. Since these materials can't store or transmit much water, substantial well water supplies aren't available there. (see *Groundwater Supplement* pp. 10-11.)

1) The sand and gravel aquifer covers most of Wisconsin, except for the unglaciated areas in the southwestern part of the state. This aquifer layer was deposited by glacial ice and river floodplains between 10,000 and 1 million years ago. Many of the irrigated farmlands in southern and northwestern Wisconsin tap this aquifer. Because the top of the sand and gravel aquifer is also the land surface, the groundwater it contains may easily become contaminated.

2) The eastern dolomite aquifer lies beneath the sand and gravel aquifer in eastern Wisconsin, and extends from Door County to the Wisconsin-Illinois border. It is made up of the Niagara dolomite formation underlain by the Maquoketa shale formation. These layers were

deposited about 400 million years ago. *Dolomite* is like limestone and contains groundwater in interconnected cracks. The yield of water from wells in this aquifer is variable and depends on the number of fractures through which a well passes. Where this fractured formation is close to the land surface, groundwater may easily be contaminated.

The Maquoketa shale layer doesn't transmit water readily. This formation isn't important as an aquifer but as a confining layer or barrier between the eastern dolomite aquifer and the sandstone and dolomite aquifer.

3) The sandstone and dolomite aquifer is made up of layers of sandstone and dolomite bedrock. Water is found in fractures in these layers. In the sandstone layer, water also occurs in pore spaces between the loosely cemented sand grains. This aquifer covers the entire state, except for the north central region. Materials in the sandstone and dolomite aquifer were deposited between 425 and 600 million years ago. This is the principal bedrock aquifer for southern and western portions of the state. Most cities and industries in eastern Wisconsin also tap this deep aquifer.

4) The crystalline bedrock aquifer is made up of a variety of rock types formed between 600 and 4,000 million years ago. This granite-like rock formation underlies the entire state. In the north central region this aquifer lies directly beneath the sand and gravel aquifer. Water is stored in cracks that may be many feet apart. To draw water from this aquifer a well must pass through some of these cracks. Good quality water can be obtained from shallow wells in this formation, but wells that penetrate deep into the aquifer have been found to yield salty water because the water becomes concentrated with salts and minerals as it passes through many rock layers.

Procedure:

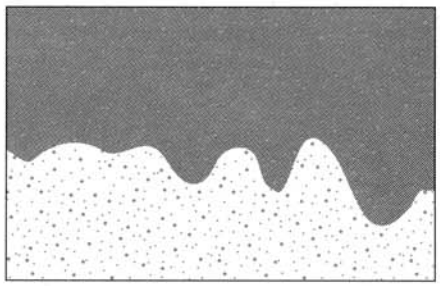
1. Discuss the background information.
2. Complete the activity sheet for either the northern or southern cross-section.
3. Discuss your answers, using "Wisconsin's Major Aquifers" overhead.

Going Beyond:

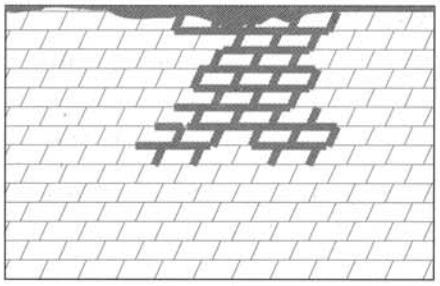
1. Visit your local water department and obtain a record of the aquifer layers under your community. Investigate what aquifer your town well taps, its depth, and how much water is pumped per minute, per day and per year. Investigate the water quality and treatment methods used.

2. Construct a geological model of your area using topographic, geologic, and groundwater susceptibility maps. Maps are available from the Wisconsin Geologic and Natural History Survey (see Resources). Using modeling clay, markers, and labels, show local soil and rock types, topography, depth to bedrock, depth to groundwater, and groundwater susceptibility. (This activity could be used as an art class project.)

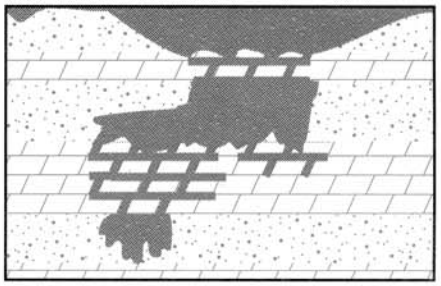
Adapted from: ***Groundwater Resources and Educational Activities for Teaching****. 1989. Iowa Department of Natural Resources.*



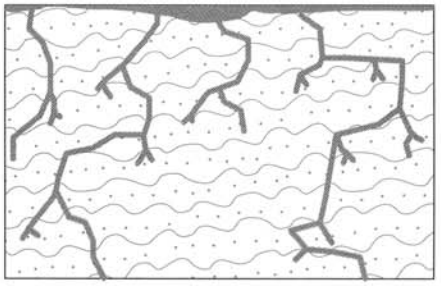
Sand & gravel aquifer



Dolomite



Sandstone & dolomite



Crystalline bedrock

Wisconsin's Major Aquifers activity sheet (Northern Wisconsin)

1. On the diagram of Wisconsin's major aquifers, label the layers of rock on the cross-section:

    a) Sand and gravel aquifer
    b) Eastern dolomite aquifer
    c) Maquoketa shale confining layer
    d) Sandstone and dolomite aquifer
    e) Crystalline bedrock aquifer

2. Use colored pencils to color the AQUIFERS different colors.

3. Answer the following questions:

a) Describe the arrangement and shape of the layers shown on the diagram.

_____

_____

_____

_____

_____

_____

b) What are confining layers?

_____

_____

c) How do they affect groundwater movement?

_____

_____

d) Name the aquifer used by each of the following cities:

Hudson _____

Eau Claire _____

Junction City _____

Stevens Point _____

De Pere _____

e) Using the scale on the left margin of the diagram, estimate the depths of wells at these cities.

Hudson _____ ft. Stevens Point _____ ft.

Eau Claire _____ ft. De Pere _____ ft.

Junction City _____ ft.

f) According to the diagram, which city's well would you expect to be the most susceptible to contamination?

_____

Why?

_____

_____

_____

g) Water that has been in bedrock a long time often contains many dissolved minerals. This water may have to be treated to improve its taste, odor or color. According to the diagram, which city's well do you think is most likely to have a problem with dissolved minerals?

_____

Why?

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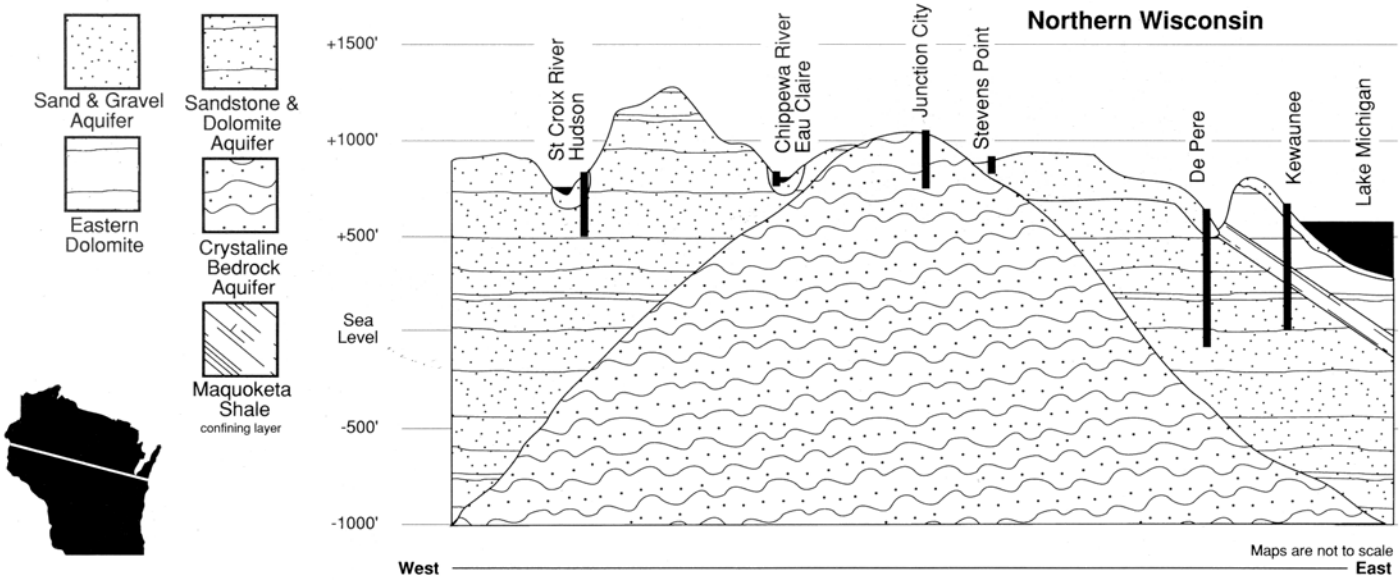

Wisconsin's Major Aquifers activity sheet (Southern Wisconsin)

1. On the diagram of Wisconsin's major aquifers, label the layers of rock on the cross-section:

   a) Sand and gravel aquifer
   b) Eastern dolomite aquifer
   c) Maquoketa shale confining layer
   d) Sandstone and dolomite aquifer
   e) Crystalline bedrock aquifer

2. Use colored pencils to color the AQUIFERS different colors.

3. Answer the following questions:
a) Describe the arrangement and shape of the layers shown on the diagram.

_____

_____

_____

_____

_____

_____

b) What are confining layers?

_____

_____

c) How do they affect groundwater movement?

_____

_____

d) Name the aquifer used by each of the following cities:

Prairie du Chien _____

Boscobel _____

Madison _____

Waukesha _____

e) Using the scale on the left margin, estimate the depths of wells at these cities.

Prairie du Chien _____ ft. Madison _____ ft.

Boscobel _____ ft. Waukesha _____ ft.

f) According to the diagram, which city's well would you expect to be the most susceptible to contamination?

_____

Why?

_____

_____

_____

g) Water that has been in bedrock a long time often has many dissolved minerals in it. This water may have to be treated to improve its taste, odor or color. According to the diagram, which city's well do you think is most likely to have a problem with dissolved minerals?

_____

Why?

_____

_____